
APPENDIX F

FIELD VERIFICATION REPORT SAVANNAH RIVER SITE APRIL 18-26, 1994



CONTENTS

EXECUTIVE SUMMARY	F-5
I.O INTRODUCTION	F-7
I.1 Purpose and Scope	F-7
1.2 Site Description	F-8
1.3 Facilities Visited	F-8
2.0 SUMMARY OF RESULTS	F-13
2.1 identification of Chemical Holdings	F-14
2.2 Facility Physical Condition.	F-15
2.3 Operational Control and Management Systems	F-16
2.4 Human Resource Programs.	F-18
2.5 Emergency Management Program	F-19
3.0 CATEGORIZATION AND PRIORITIZATION OF VULNERABILITIES	F-21
3.1 Criteria	F-21
3.2 Chemical Safety Vulnerabilities at Savannah River Site	F-22

ATTACHMENTS

ATTACHMENT 1. Team Composition	F-25
ATTACHMENT 2. Vulnerability Forms	F-27
Attachment 3. Selected Acronyms	F-47

EXECUTIVE SUMMARY

This report presents the results of a review of chemical safety vulnerabilities associated with facilities owned or operated by the Department of Energy (DOE) at the Savannah River Site (SRS). This review is part of the Chemical Safety Vulnerability Review directed by the Secretary of Energy and being lead by the Office of Environment, Safety and Health with full participation of line organizations with operational responsibilities. The purpose of the review is to identify and characterize conditions or circumstances involving potentially hazardous chemicals at DOE sites and facilities, with emphasis on facilities being transitioned to, awaiting, or undergoing decontamination and decommissioning (D&D). Specifically, the review is designed to identify, characterize, and prioritize facility-specific and generic chemical safety vulnerabilities associated with conditions or circumstances may result in (1) fires or explosions from uncontrolled chemical reactions, (2) exposure of workers or the public to chemicals, or (3) releases of chemicals to the environment.

Activities reviewed at SRS in which hazardous chemicals were involved included laboratories, process facilities, utilities, nuclear reactors, decontamination, and waste treatment and storage facilities. Specific facilities were selected for review based on the desire to evaluate chemical hazards associated with facilities at different points in their life cycle. The facilities selected included a facility being prepared for startup, operating facilities, abandoned facilities, a facility being prepared for turnover for D&D, and a facility engaged in decommissioning activities.

The field verification team noted that the chemical safety program at SRS has made significant improvements since the DOE chemical safety oversight review was conducted in 1992. The overall chemical safety program at SRS appears to be moving in a positive direction. Management at the Westinghouse Savannah River Company (WSRC) understands the issues that must be addressed, and a concentrated effort is under way to improve problem areas. Efforts by WSRC management to “get their hands around” the implementation of a complete chemical safety program should continue. This implementation should be closely coordinated to ensure that initiatives do not become fragmented across the site. The field verification team’s greatest area of concern focused on inadequate hazards analysis for some facilities and work activities.

Chemical safety vulnerabilities represented by weaknesses or potential weaknesses were identified and are listed below in order of priority, none of which represent a condition or circumstances with the potential for severe near-term consequence:

- Some facilities and work packages are not receiving adequate hazard analysis. These conditions and circumstances represent a medium-priority vulnerability with a potential for short-term consequences.
- Knowledge about and characterization of chemical residuals at some facilities are not adequate. These conditions and circumstances represent a low- to medium-priority vulnerability with a potential for short-term consequences.
- In some cases, knowledge about chemicals and chemical inventory and the hazards communication program are not adequate. These conditions and circumstances represent a low- to medium-priority vulnerability with a potential for short-term consequences.

- WSRC lacks a fully developed and implemented chemical safety program. These conditions and circumstances represent a low-priority vulnerability with a potential for short-term consequences.
- Shifting departmental priorities are having an adverse affect on the site's overall chemical safety program. These conditions and consequences represent a low-priority vulnerability with potential for short-term consequences.

In addition, the field verification team identified several commendable practices at SRS, including the following:

- Development of an industrial hygiene program planning document,
- Use of a "blue dot" program to identify containers holding hazardous chemicals,
- Replacement of gaseous chlorine with sodium hypochlorite at water treatment facilities,
- Implementation of a chemical salvage program for reactor areas,
- Implementation of a safety observer program, and
- Exchange of information related to chemical safety with Westinghouse Hanford.

1.0 INTRODUCTION

1.1 Purpose and Scope

Based on direction from the Secretary of Energy, the Assistant Secretary for Environment, Safety and Health established the Chemical Safety Vulnerability Working Group to review and identify chemical safety vulnerabilities at facilities operated by the Department of Energy (DOE). The information obtained from the review will provide the Working Group with valuable input for identifying generic chemical safety vulnerabilities that confront the DOE complex. Prioritizing the generic chemical safety vulnerabilities that are identified will establish the proper basis for departmental focus on programs, funding, and policy decisions related to chemical safety. The Secretary directed the Office of Environment, Safety and Health to lead the review, with full participation from DOE line organizations with operational responsibilities.

The Chemical Safety Vulnerability Review was designed and undertaken to identify and characterize adverse conditions and circumstances involving potentially hazardous chemicals at facilities owned or operated by the Department. Specifically, the review was intended to identify, characterize, and prioritize chemical safety vulnerabilities associated with conditions or circumstances that might result in (1) fires or explosions from uncontrolled chemical reactions, (2) exposure of workers or the public to hazardous chemicals, or (3) release of hazardous chemicals to the environment. Using input provided by line organizations with operational responsibilities, the Working Group developed a project plan¹ to guide the review.

This report documents activities related to the field verification phase of the Chemical Safety Vulnerability Review. The field verification process was designed to use independent teams of technical professionals with expertise in a variety of technical disciplines to verify the accuracy and completeness of the data compiled during the field self-evaluation phase of the review. The field self-evaluation process used a standard question set developed and distributed by the Working Group to collect data related to chemical safety from 84 facilities located at 29 sites. Based on analysis of self-evaluation data, nine sites, including the Savannah River Site (SRS), were selected to participate in the field verification phase of the review.

The field verification team visiting SRS examined a broad range of facilities (based on facility type and operational status), with special attention given to those facilities being transferred to, awaiting, or undergoing decontamination and decommissioning (D&D). Different types of chemical- and waste-handling facilities were reviewed at SRS, including laboratories, process facilities, utilities, nuclear reactors, decontamination facilities, and waste treatment and storage facilities, to permit identification of chemical safety vulnerabilities. Facilities selected for review included a facility being prepared for startup, operating facilities, abandoned facilities, a facility being transitioned to D&D, and a facility involved with decommissioning. Specific facilities were selected for review based on the desire to review chemical hazards associated with facilities at different points in their life cycle.

¹ "Project Plan for the Chemical Safety Vulnerability Review," dated March 14, 1994.

The field verification team, under direction of a DOE team leader, was composed of DOE and contractor personnel with technical expertise in various aspects of chemical safety, including management, operations, training, chemical process safety, industrial hygiene, maintenance, environmental protection, and emergency preparedness. A team composition list is provided in Attachment 1 of this appendix.

The team met with management or technical representatives from DOE and contractor organizations. Individual and small group meetings were also held, and team members conducted **walkthroughs**, document reviews, and personnel **interviews** to gather information related to potential chemical vulnerabilities at SRS. The team leader met daily with management personnel to discuss the team's activities and issues that may have surfaced during the previous day. Before the field verification team left SRS, management from local DOE and contractor organizations conducted a factual accuracy review of the draft report. An **outbriefing** was conducted for DOE and contractor management on Tuesday, April 26, 1994. A draft copy of this report was left with DOE and contractor management.

1.2 Site Description

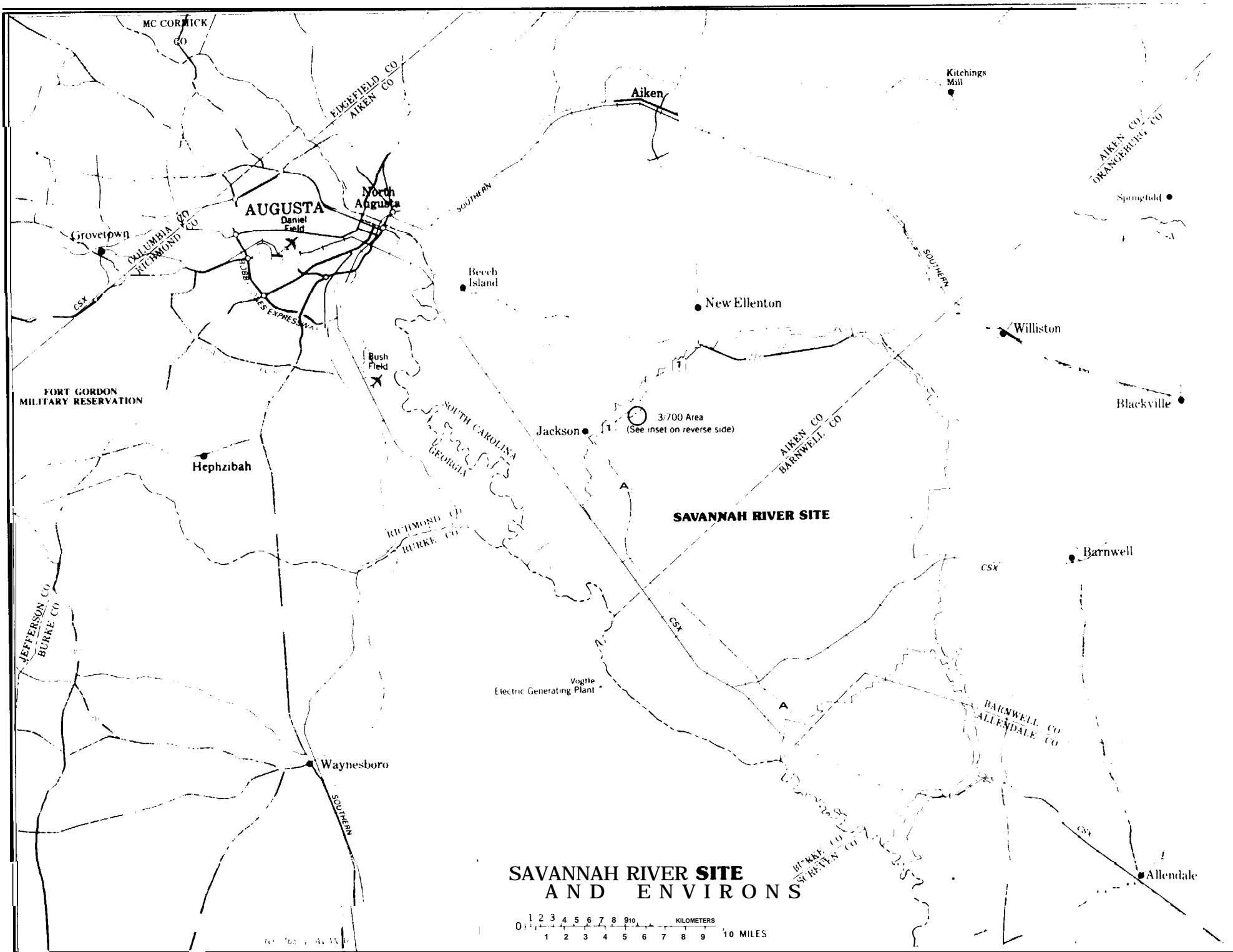
The SRS occupies an area of about 300 square miles adjacent to the Savannah River, principally in Aiken and **Barnwell** Counties of South Carolina, and about 25 miles southeast of Augusta, Georgia. SRS has been operated for the DOE by the Westinghouse Savannah River Company (**WSRC**) since April 1989. SRS has produced plutonium, **tritium**, and other special nuclear materials for national defense. SRS has also produced nuclear materials for other Government and civilian purposes. (See figures that follow.)

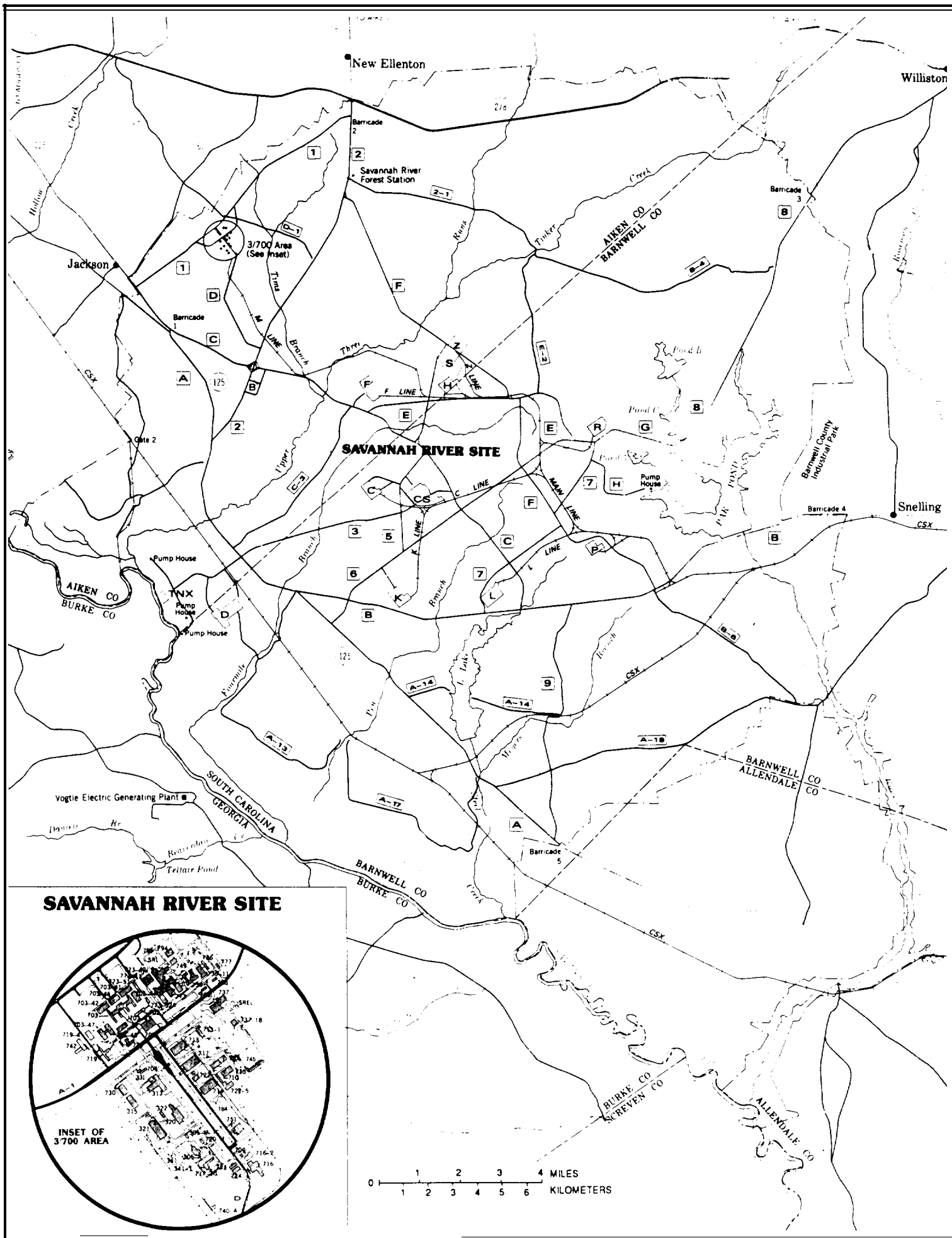
SRS is composed of six major production areas in which a variety of hazardous chemicals and wastes are located and used, including reactor areas, separation areas, waste management areas, the Heavy Water Reprocessing Area and powerhouses, the Reactor Materials Area, and the Administration Area.

1.3 Facilities Visited

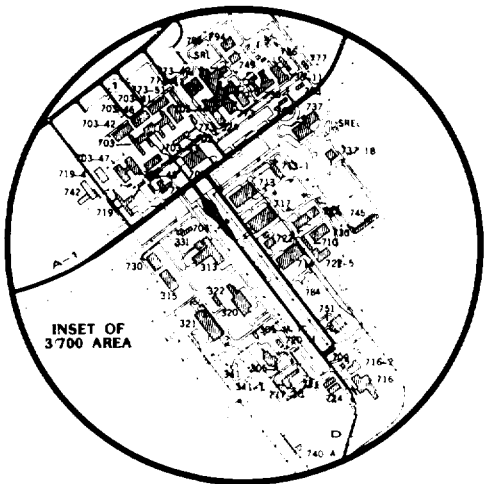
Because visiting every facility at the site was not possible under the constraints of this review, the Working Group focused its efforts to achieve the maximum results possible in the time available. Six facilities at SRS were selected to participate in the self-evaluation phase of the chemical safety vulnerability review. The intent of the team was to verify the self-evaluation data for those facilities participating in that phase. Based on detailed analysis of the **self-evaluation** data, it was determined that insufficient chemical hazards existed to warrant verification at one facility. Two additional facilities were determined to need only a cursory visit to verify data. To allow the team the opportunity to review a variety of chemical hazards at SRS, eight additional facilities were visited during the verification effort. Some of the added facilities received only a brief review. Facilities that were reviewed by the field verification team at SRS included the following:

L Reactor and P Reactor: L Reactor and P Reactor are two of five reactors placed in service during 1953-5. These nuclear reactors operated at low pressure and were moderated and cooled by heavy water. Secondary cooling was provided by water from the Savannah River. The reactors are housed in buildings heavily shielded with concrete to protect





SAVANNAH RIVER SITE



personnel from radiation exposure. Irradiated assemblies were discharged from the reactors to the fuel and target storage basin and eventually sent to Separations and Tritium for processing. L Reactor was taken out of service in 1968 and placed back in service in 1985. Both L and P Reactors were taken out of service in 1988 and have been placed in shutdown mode.

184-P Powerhouse: The 184-P Powerhouse is a coal-burning powerhouse with two stoker boilers. It provided power and steam to the P Reactor Area. This powerhouse was taken out of service in 1990 and is now abandoned.

315-M Essential Materials Storage: This building is a storage (and former receiving) area for essential materials used in the 300 Area. Before distribution and use in the 300 Area processes, essential materials are inspected and approved. The inspection equipment, methods of inspection, maintenance of stock and inventory records, and the routine operations are described in administrative procedures.

316-M Mixed-Waste Storage Shed: Building 316-M is considered part of the mixed waste storage shed (MWSS). This building is a covered shed structure with a concrete base and is surrounded by security fencing. The MWSS is used primarily for the storage of 55-gallon drums, but can also receive 90-cubic-foot boxes or special containers. The total capacity of drums and boxes combined shall not exceed the capacity equivalent to 560 55-five gallon drums. The types of wastes currently stored are F006 filterpaper and filtercake, D002/D009 plating line solutions, F-listed solvent rags, toxicity characteristic leachate procedure (TCLP) wastes (D0004-D043), D0001 ignitable, and D003 corrosive wastes. Some of this material is considered "mixed" waste because it is listed as a hazardous waste and is also radioactive.

320-M Analytical Laboratory: The 320-M Analytical Laboratory previously supported the 300-M Area Reactor Materials Production plants. Today, in the absence of 300-M Area production activities, it provides analytical services for several departments. Its future is being evaluated.

483-D Chlorination Facility: The chlorination facility previously used gaseous chlorine to chlorinate water in 400-D Area for use in process and domestic water systems. Chlorination prevents biofouling in water plant precipitators and filters, and provides residual chlorine in domestic water. The site initiated efforts in early 1993 to replace gaseous chlorine, and liquid sodium hypochlorite has replaced the gaseous chlorine.

717-9 P Excess Chemicals Facility: The excess chemicals facility was recently established. Excess chemicals from all the reactor areas were brought to this facility for reissue or other disposition. The facility will be used as a clearinghouse for excess chemicals at SRS.

412-D Heavy Water Extraction Facility: The heavy water extraction facility was an isotope exchange process that used the Girdler-Sulfide process to concentrate deuterium. The Girdler-Sulfide process used hydrogen sulfide as a circulating carrier to transport deuterium from hot to cold water in successive stages. This facility is undergoing partial D&D.

H Area High-Level Waste Tank Farm: The tank farm is composed of 29 waste tanks, ranging in volume from 750,000 to 1,300,000 gallons, and two evaporators. Four tanks are used for pretreatment of salt for vitrification, and three are used for pretreatment of sludge. High-level waste is transferred to the tank farm from the 221-H Separations Canyon Facility. Waste is aged in the tanks to allow short-lived radionuclide decay and phase separation. On separation, the aqueous phase is evaporated to reduce volume and mobility. This is an operating facility.

241-96 H In-Tank Precipitation Facility: The In-Tank Precipitation (ITP) Facility treats and separates radioactive salt solutions into two waste streams, a decontaminated salt solution and a concentrated precipitate slurry. ITP consists of four H Area Tank Farm tanks, a large crossflow filter, and two benzene stripper columns. The slurry is transferred to the Defense Waste Processing Facility for vitrification and the decontaminated salt solution is transferred to the Salt Stone Grouting Facility for solidification. This facility is being prepared for startup.

299-H High-Level Waste Maintenance Facility: The High-Level Waste Maintenance Facility is used for the decontamination, and subsequent repair, of contaminated and/or failed equipment. The facility has a 1,680-gallon waste collection tank for mixed waste. This is an operating facility.

F Area Concentrate Transfer System: The F Area Concentrate Transfer System is an 11 ,700-gallon tank that was used to collect concentrated waste from the 242-F Area Evaporator transfer lines. This system allows concentrate to be directed to any of three receipt waste tanks. The system also contains pumps needed to move the concentrate through the transfer lines. This facility is in inactive shutdown.

2.0 SUMMARY OF RESULTS

The field verification process was designed to use independent teams of safety professionals to verify the accuracy and completeness of the data provided to the Chemical Safety Vulnerability Working Group by SRS facilities selected to participate in the field self-evaluation process. The verification process offered an opportunity to examine potential chemical safety vulnerabilities and to make informed judgments about the seriousness of these conditions.

The goal of the field verification visit was to develop a prioritized list of chemical safety vulnerabilities at SRS. Before arriving on site, the team reviewed the self-evaluation data and other documents to allow team members to develop a list of observations related to potential vulnerabilities for their functional areas. During the onsite portion of the review, team members visited the facilities that participated in the self-evaluation effort to verify reported observations and to look for other conditions and circumstances that may result in chemical safety vulnerabilities. In some instances, facilities or areas that were not involved in the original self-evaluation were also reviewed and have provided valuable information for the review.

To support effective team management and to expedite the identification of vulnerabilities across a wide range of technical disciplines associated with chemical safety, each field verification review has been organized to include five functional areas:

- Identification of chemical holdings, including the properties of chemicals located at the facility, the characterization of those chemicals, and an analysis of the inventory.
- Facility physical condition, including engineered barriers, maintenance conditions, chemical systems, safety systems, storage, monitoring systems, and hazards identification.
- Operational control and management systems, including organizational structure; requirements identification; hazard analysis; procedural adherence; maintenance control; engineering and design reviews; configuration control; safe shutdown plans; and site programs for quality assurance, chemical safety, inventory control, access control, disposal, transportation and packaging, and corrective actions.
- Human resource programs, including technical competence, staffing, training and qualifications, employee involvement, employee concerns, personnel performance requirements, and visitor and subcontractor control.
- Emergency management program, including the emergency response plan, in-plant consequences, environmental issues, coordination with the community, and community right-to-know issues.

These functional areas were evaluated on the basis of lines of inquiry provided in Attachment 1 of the "Field Verification Guide for the Chemical Safety Vulnerability Review," dated April 8, 1994. Verification of the self-evaluation data was accomplished by walkthrough of facilities, conduct of interviews with management and technical personnel, examination of facility and site documentation, and review of incident reports and other documents. Summaries of the functional areas are provided in the sections below.

Five vulnerabilities were identified as a result of the SRS field verification: (1) some facilities and work packages are not receiving adequate hazards analysis; (2) knowledge about and characterization of chemical residuals at some facilities is not adequate; (3) in some cases, knowledge about chemical inventory and the hazards communication program is not adequate; (4) WSRC lacks a fully developed and implemented chemical safety program; and (5) shifting departmental priorities are having an adverse effect on the site's overall chemical safety program.

Commendable practices identified related to chemical safety at SRS include (1) development of an industrial hygiene planning document, (2) use of a "blue dot" program to identify containers with hazardous chemicals, (3) replacement of gaseous chlorine with sodium hypochlorite at water treatment facilities, (4) implementation of a chemical salvage program at reactor areas, (5) implementation of a safety program, and (6) exchange of information related to chemical safety with Westinghouse Hanford.

Overall, it was the field verification team's opinion that the SRS self-evaluation document provided a fair and thorough representation of conditions at the facilities reviewed. Several minor inconsistencies in the self-evaluation were resolved between the field verification team and WSRC. With help from SR and WSRC personnel, the field verification team was able to provide additional insights on chemical safety vulnerabilities at SRS. The following sections summarize the field verification team's understanding of chemical safety programs at SRS. Where applicable, specific chemical safety vulnerabilities are referenced. Completed vulnerability forms are provided in Attachment 2 of this appendix.

2.1 Identification of Chemical Holdings

Storage practices for process chemicals in facilities visited at SRS appeared to be appropriate. One concern exists regarding the storage of large amounts of sodium tetraphenylborate, which is a marginally stable solution used in high-level waste processing, at the In-Tank Precipitation Facility. Chemical residuals were identified in several older facilities awaiting or involved with D&D type activities. However, procedures for flushing line and process vessels in newer facilities should minimize residues in the future. Observed storage practices for hazardous chemical wastes were good, and a recently started salvage program should further reduce those holdings. There is, however, no management program that tracks hazardous chemicals throughout their existence at SRS.

For the areas reviewed, chemical inventories varied from essentially zero for some inactive facilities to large storage tanks for caustic acids and liquid nitrogen at some operating facilities or facilities being prepared for startup. Systems to support safe holdings of these process chemicals were in order. In most cases, the inventories were appropriate for the activity being performed. At the In-Tank Precipitation Facility, an evaluation is being performed to determine whether the onsite quantity of a benzene-emitting material (sodium tetraphenylborate) can be brought into the facility on an as-needed basis instead of maintaining a large amount (up to 188,000 gallons) of the solution, which could degrade excessively with time and temperature. Additional concerns about use of this chemical have been raised recently because of a drum overpressurization at the vendor's facility due to unexpectedly rapid benzene emission from solid sodium tetraphenylborate. The overpressurization occurred shortly after dehydrating an aged batch of solution and was triggered by trace impurities. This situation prompted WSRC

to perform additional studies on the safe handling and use of sodium tetraphenylborate. Although the final decision has not been made regarding receiving and holding this chemical, it is evident that minimizing the inventory of this marginally stable compound should reduce the vulnerability associated with personnel and property exposure to benzene, which is carcinogenic (see Vulnerability CSV-R-SRS-000-01).

Operating personnel stated that, on completing a production run, lines are flushed or gravity precludes accumulation of process chemicals or residues in those lines; for example, this practice was defined as part of the procedure for decontaminating equipment in the 299-H High Level Waste Maintenance Facility. Some process residues that cause concern remain in inactive facilities undergoing or awaiting D&D-type activities (see Vulnerability CSV-R-SRS-000-01). Most residues are minor, but some (e.g., a tarlike substance with a pH of 1 at the 412-D Heavy Water Extraction facility column) remain uncharacterized. In addition, sulfate coatings on the interior of processing lines at the 412-D facility have proven to be a health threat in that a worker appeared to have inhaled noxious gas after the high temperature cutting of one of the pipes. Although site work control does require hazards assessment, the inhalation event occurred on November 11, 1993, and the procedure used in this activity has not been updated (as of April 22, 1994) to ensure appropriate technical reviews will be performed before cutting into pipes or vessels that could contain process chemical residues (see Vulnerability CSV-R-SRS-000-02).

Chemical inventories were controlled, but there is no management program in some facilities to track chemicals from the time they are brought on site until they are used or properly disposed. The Reactor Division operates a formal Chemical Salvage program to reduce chemical inventories, but it is not part of any sitewide system. Through this program, abandoned (e.g., cleaning products) and unwanted or unneeded chemicals are recycled. In addition, onsite inventories of chemicals are reduced and, in many cases, requirements for waste disposal are reduced. The storage of hazardous liquid and solid waste in these facilities was performed in a well-controlled and safe manner.

2.2 Facility Physical Condition

For the facilities reviewed at SRS, the mechanical integrity of the primary and secondary containment systems and the equipment for handling hazardous chemicals was determined to be good, even when age and operating status of the facilities were considered. The mechanical integrity of pressure vessels, boilers, and process piping at SRS is closely monitored by maintenance and operations personnel with support from several engineering committees including, but not limited to, the Pressure Protection Committee and the newly formed Piping Committee. Maintenance management systems are in place to minimize the potential of change in system function as a result of maintenance activities.

The site Pressure Protection Committee coordinates activities related to the original and continued adequacy of pressure vessels and pressure relief devices. Pressure vessels and boiler external piping are ultrasonically tested on a schedule based on how crucial the system is to site operations and the severity of the consequences of vessel failure. During 1993, an employee received second degree burns from concentrated sulfuric acid spray when a 1-inch-diameter line (not previously inspected) failed. A multidisciplinary piping committee was chaired, assembled, and funded in 1994 to determine the inspection requirements for nuclear

safety and critical protection equipment, including piping. Five facilities have been selected for detailed piping inspection using applicable ultrasonic, radiographic, or one of several surface inspection techniques during the next 12 months. Piping inspection activities are expected to expand, as warranted, sitewide. When containment systems must be breached, formal written procedures must be approved by the Cognizant Systems Engineer. A safety review and a quality assurance review of all procedures are required.

A work control program is in place defining preventive and mitigative measures for nonroutine work activities. For example, the Work Clearance Permit authorizes personnel to begin work once signatures on the permit indicate all work groups are satisfied that (1) equipment and area have been prepared for the assigned work, (2) necessary safety precautions have been taken, and (3) regulatory permits have been received.

Engineering design safeguards to promote worker safety are included in facility design or modification. Health and safety personnel interface with engineering design personnel during project review with the intent being to ensure all safety and health issues have been addressed. Depending on the severity of the consequences of failure, design authority approval requires a process hazards review, safety analysis report, unreviewed safety question determination, and/or a hazards assessment document with each facility design or modification package.

The Chemical Safety Oversight Review (dated November 1992) indicated that the chlorine storage facilities, in the 400 D Area and at the 5-G Pumphouse, were high-risk facilities because of the quantity of gaseous chlorine stored on site and the proximity of both facilities to the site boundary. As a result, water treatment with gaseous chlorine has been replaced by treatment with liquid sodium hypochlorite, and chlorine cylinders have been returned to the supplier. Gaseous chlorine is no longer a chemical safety vulnerability at SRS.

The reduction in maintenance staff through budget reduction, personnel transfer, retirement, and facility shutdown will continue to result in loss of experienced personnel who have intimate knowledge of unrecorded aspects of first generation facilities. Such information could prove invaluable during D&D activities. This loss of experience level has the potential to adversely affect the site's chemical safety program (see Vulnerability CSV-R-SRS-000-05).

2.3 Operational Control and Management Systems

WSRC management has recognized those areas where systems and programs are needed to promote chemical safety at SRS and has established several programs that collectively support chemical safety. WSRC is developing and implementing other management initiatives and improvements related to chemical safety, such as the recently approved Chemicals Commodities Management Center, but progress has been hampered by a fragmented approach and the lack of central program direction. Until these systems are in place, SRS will not have an effective overall chemical safety program. In some cases, the effectiveness of the present chemical safety program is diminished by lack of thorough industrial hygiene review of work packages for job hazards analysis. Other factors leading to weaknesses are a DOE-imposed accelerated schedule for transition of surplus facilities and a site welding and cutting manual that has not been revised to reflect the need for technical assessment of potential internal contaminants in pipes and vessels.

WSRC has initiated several management systems and programs to address certain elements of a sitewide chemical safety program. For example, Process Hazards Reviews are performed to identify, prevent, mitigate, or control chemical hazards for all new processes or process modifications involving chemicals in quantities greater than those designated as Immediately Dangerous to Life and Health. Other management tools, such as the lessons-learned program and the WSRC performance appraisal system, require only minor changes to support chemical safety more fully at SRS.

Several important management tools and systems that are not in place or fully implemented but have been recognized by WSRC as required include: (1) a sitewide system for procuring, managing, controlling, tracking, and disposing of hazardous chemicals; (2) configuration management of processes, equipment, and facilities involving hazardous chemicals; (3) a Process Safety Management (PSM) Program as defined in 29 CFR 1910.119; and (4) a program that defines the requirements for transition of surplus facilities from program offices to the Office Facility Transition and Management (EM-60) and that incorporates the need for characterization of chemical residues. In all of these cases, WSRC has plans or initiatives under way (e.g., the Chemical Commodities Management Center concept). Lack of sitewide direction has resulted in fragmented initiatives across SRS, and even though these initiatives are under way, they represent a vulnerability until they are fully implemented (see Vulnerability **CSVR-SRS-000-04**).

The WSRC Occupational Safety and Hygiene Department has implemented a comprehensive industrial hygiene hazard assessment program. Procedures for program compliance are in place but not always effective. The Hazard Implementation and Control Program ensures that potential employee exposures to hazardous chemicals are reviewed. Industrial hygiene baseline assessments have been completed for all operations areas having potential occupational health hazards. In addition to their other duties, some members of the industrial hygiene staff review as many as 50 work packages per week. At times, pressure is exerted on the department by work-package originators to provide a quick turnaround of work packages. As D&D activity increases, this problem will increase. In addition, industrial hygiene staff are not always requested to participate in the pre-bid phase (to review planned work) **for subcontractors**. **As a result of these factors, industrial hygiene review of internal work packages may not always provide for a complete or consistent job hazards analysis** before work is started (see Vulnerability **CSVR-SRS-000-03**).

Safety documentation (safety analysis reports, justifications for continued operation, and safety assessments) was reviewed for two facilities. Both were appropriate for the hazards involved. No discernable, unidentified chemical vulnerabilities were found as a result of these document reviews. However, the degradation of the sodium tetraphenylborate solution to benzene under storage conditions raises questions about maintaining large quantities of tetraphenylborate solutions onsite (see Vulnerability **CSVR-SRS-000-01**).

Approved procedures are in place to control onsite transfer of hazardous chemicals and hazardous chemical wastes. The Hazardous Materials Transfer Representative Program is in place to assist operations personnel with nonroutine hazardous chemicals transfers. No vulnerabilities were identified in the area of packaging and onsite transfer of hazardous chemicals.

Neither of the site welding manuals identifies the need for technical assessment of any potential internal chemical contaminants that could be encountered during a welder cutting or welding of pipes or vessels. The requirement has not been incorporated into either manual, even though an incident involving the 412-D Heavy Water Extraction Facility incident occurred 6-months ago (see Vulnerabilities CSV-R-SRS-000-OI, CSV-R-SRS-000-02, and **CSV-R-SRS-000-03**).

WSRC has established a decommissioning policy defining the actions to transition surplus facilities from operating status to D&D. This policy includes requirements for the development of a facility transition plan, the characterization of facilities for chemical residues, and the surveillance and maintenance of facilities. All requirements of the decommissioning policy have not been implemented at SRS. Thus, detailed requirements are not in place for transfer of shutdown facilities to EM-60. WSRC had expected to have a fully implemented decommissioning program in place in about 18 months. However, recent direction from DOE Headquarters has accelerated this program (i.e., within the next 6 months). Lack of sufficient resources for this accelerated effort and the accelerated schedule for implementing this program may contribute to a weakness in that insufficient implementation time and funds may not permit proper planning for and characterization of chemical hazards before transfer of facilities EM-60 (see Vulnerabilities CSV-R-SRS-000-02, CSV-R-SRS-000-03, and **CSV-R-SRS-000-04**).

2.4 Human Resource Programs

In general, WSRC has developed extensive and well-defined environment, safety, and health (ES&H) training programs that include both general chemical safety awareness and hazards associated with chemical process safety. However, concerns exist about control of employee access to facilities and, in some areas, definition of training needs.

Various types of on-the-job and classroom training that relate to chemical safety and hazard recognition are conducted at SRS. All DOE and contractor personnel are required to complete a 4-hour general employee training (GET) course. This course satisfies the general training requirements for information, safety, and emergency management common across all SRS facilities. WSRC conducts facility-specific orientation training within each major facility on site to provide employees with additional information regarding facility-specific hazards. Job-specific training is also provided, as needed, to conduct operations safely.

With the exception of job-specific (operations, maintenance, and technical) courses, training on chemical hazards and chemical hazards recognition is conducted within the facility-specific training or hazard communication (HAZCOM) courses. This training is appropriate and well administered at SRS. However, completion of facility-specific training or HAZCOM training is not verified consistently before DOE, contractor, and subcontractor personnel are granted access to areas where chemical hazards exist. Tritium and HB-Line are the only SRS facilities that restrict access to personnel who have not completed the requisite facility-specific training. Access is controlled through issuance of a proximity badge. The badge was originally developed to restrict personnel access for security reasons, but the process is being used effectively by these facilities as an administrative control to limit access to properly trained personnel. No other facilities at SRS, including the High-Level Waste Tank Farms,

the In-Tank Precipitation Facility, and the Defense Waste Processing Facility, control access in this manner (see Vulnerability CSVR-SRS-000-04).

Effective and viable hazardous waste operations and emergency response (HAZWOPER), HAZCOM, and hazardous materials (HAZMAT) training is provided at SRS. HAZWOPER training is required by WSRC procedures for employees (typically hazardous waste workers) likely to be exposed to hazards while in Resource Conservation and Recovery Act (RCRA) regulated treatment, storage, and disposal (TSD) facilities, but other TSD workers and visitors, who are considered “not likely to be exposed” to hazards, are not required to complete HAZWOPER training and are not required to be escorted by HAZWOPER-trained personnel. Since training of these employees is not reviewed as part of access control at TSD facilities (nor in many other areas where significant chemical hazards are present), the sole administrative burden of ensuring that applicable training is complete and current is being placed on supervisors and individual employees.

Additional job-specific chemical process safety training is provided to personnel who have a higher risk of exposure to hazardous chemicals. Training for operations, maintenance, and technical contractor and subcontractor personnel is designed to ensure that ongoing operations and facilities startup are conducted safely. However, training for many positions at SRS is not consistently defined or controlled. Although training requirements and associated qualification cards are well defined in many areas, most notably in new facilities entering startup and responding to concerns identified during Operational Readiness Reviews and by the Defense Nuclear Facilities Safety Board, training requirements for job positions in some facilities and departments are not as comprehensive nor as well controlled. In addition, the use of comprehensive qualification testing to verify the effectiveness of worker training is inconsistent across the site. The Training Records and Information Network (TRAIN) data base is used to document training that has been completed by employees, but consistent sitewide use of the data base as a training requirements tool has not been fully achieved (see Vulnerability CSVR-SRS-000-04).

Staffing levels to provide ES&H training are adequate. Staffing levels also appear adequate to enable workers to perform work safely in work areas where chemical hazards are present. Employee involvement is encouraged through effective DOE and contractor employee concerns programs. Chemical safety concerns or issues raised by SRS employees (typically involving workers concerned about their safety while working with or around hazardous chemicals) have been investigated and appropriately closed.

2.5 Emergency Management Program

The emergency management program supports chemical safety at SRS and is improving in the area of preparation for chemical emergencies. Facility-specific emergency planning related to chemical safety is also improving. One major area of weakness was identified related to chemical emergency preparedness—that is, inadequate and incomplete chemical safety analysis and hazards analysis information (see Vulnerability CVSR-SRS-000-01).

Many significant improvements in chemical emergency management have occurred at SRS since the Chemical Safety Oversight Review was conducted in 1992. More emphasis is now given to chemical emergencies in exercises and drills. Both facility-specific and sitewide

hazardous chemical emergency drills are being conducted. Some chemical emergency action levels have been developed, and the classification matrix includes a general initiating condition categorized as "toxic chemical release." Coordination with offsite authorities and organizations is increasing; 13 letters of agreement for offsite support exist at present, and development of an additional agreement is in progress. Onsite HAZMAT training is offered and provided to offsite HAZMAT support organizations that might respond to onsite emergencies. Training in hazardous materials emergency response that meets the requirements of 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response," is provided to selected area emergency response personnel.

The Weather Information and Display System is available in area control rooms and the Dose Assessment Center and is used as an aid in protective action decision making when the incident involves an actual or potential release of hazardous material to the environment.

A technical advisor from the Industrial Hygiene Department is being assigned to the staff of the Incident Command Post to provide additional chemical expertise to support the Fire Department HAZMAT Team during responses to hazardous chemical emergencies. General employee training and job performance brochures have been developed and distributed to fit into a wallet or badge holder and to contain emergency response information specific to major areas of the site. These pocket brochures include the National Fire Protection Association chemical hazards recognition symbols/ratings. These items are recognized by the review team as general employee training, emergency preparedness, and "good management practices" for chemical safety.

One area of weakness was determined; the emergency management program is based on inadequate chemical safety analysis and hazards analysis information for emergency planning purposes (see Vulnerability CVSR-SRS-000-01). Some safety documents with information related to chemical safety, such as safety analysis reports, have not been updated for about 10 years. Emergency planning at SRS includes measures to account for the lack of complete facility chemical safety analyses. Information from chemical safety and hazard analyses is a basis for developing emergency preparedness plans and procedures. Upgraded chemical safety and hazards analyses are just beginning to be developed for nonnuclear facilities and are incomplete. Without complete chemical safety analysis and hazards analysis information, the adequacy of emergency planning zones cannot be confirmed; emergency classification recognition criteria and emergency action levels cannot be fully developed; and protective actions for employees, the public, and the environment cannot be definitively assessed.

3.0 CATEGORIZATION AND PRIORITIZATION OF VULNERABILITIES

3.1 Criteria

A vulnerability is defined as a weakness or potential weakness involving hazardous chemicals that could result in a threat to the environment, the public, or worker health and safety. Vulnerabilities can be characterized by physical or programmatic conditions associated with uncertainties, acknowledged deficiencies, and/or unacknowledged deficiencies in the area of chemical safety. Conditions required to create the vulnerability should either currently exist or be reasonably expected to exist in the future based on degradation of systems and chemicals or through expected actions (i.e., D&D of facility).

A vulnerability will be determined to exist if current or expected future conditions or weaknesses could result in the following:

- The death of or serious physical harm² to a worker or a member of the public or continuous exposure of a worker or member of the public to levels of hazardous chemicals above hazardous limits; or
- Environmental impacts through the release of hazardous chemical above established limits.

Prioritization of the chemical safety vulnerabilities is based on the professional judgment of team members concerning the immediacy of the potential consequences posed by a vulnerability and on the potential severity of those consequences. The first step in the prioritization process was to group vulnerabilities according to the timeframe in which they are expected to produce consequences. The following categories have been established for the timeframe within which the consequences are expected to occur:

- Immediate — Any chemical safety vulnerability that could result in immediate consequences.
- Short-Term — Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring within a 3-year timeframe as a result of chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.
- Medium-Term — Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring within a 3–10-year timeframe as a result of chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.

²Serious physical harm is defined as impairment of the body, leaving part of the body functionally useless or substantially reducing efficiency on or off the job.

- **Lena-Term** — Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring within a timeframe of more than 10 years as a result of chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.

Vulnerabilities within each category should be further prioritized to specify “high,” “medium,” or “low” priority based on the severity of the potential consequences. Examples of the second level of prioritization include the following:

- Prioritize potential harm to workers or the public according to the possible level of injury and/or health effect, ranging from transient reversible illness or injury to death.
- Prioritize environmental impacts based on the level of irreversible damage and/or restoration costs.

3.2 Chemical Safety Vulnerabilities at Savannah River Site

Five vulnerabilities were identified during the field verification review at SRS. They were prioritized in accordance with the protocol stipulated in the project plan.³ The prioritization process considered both the timeframe in which the vulnerabilities could possibly produce consequences and the potential severity of the consequences. The team determined that one of the vulnerabilities should be considered to have short-term consequences, with the other four having immediate consequences. The potential severity of consequences ranged from low to medium for the five vulnerabilities. The chemical safety vulnerabilities identified at SRS are discussed below in order of priority, highest priority first.

CSV-SRS-000-01: Some facilities and work packages are not receiving adequate hazards analysis.

In some cases, the chemical safety and hazard analyses for work planning and emergency response are not complete or adequate. Thorough hazards analysis review for chemical safety as it relates to D&D-type activities is not always accomplished, as demonstrated by a recent incident at the 412-D Heavy Water Extraction Facility. Pressure to complete work package reviews and lack of consistent involvement by industrial hygienists in the pre-bid phase for subcontractors have resulted in reviews of work packages that are not always thorough or complete. The emergency management program is based on inadequate chemical safety analysis and hazards analysis information. Safety analysis documentation, which includes chemical safety and hazards analyses, has not been upgraded for all (including nonnuclear) facilities at SRS. This results in the potential lack of analysis for accident scenarios related to chemicals and chemical processes. These conditions and circumstances represent a medium-priority vulnerability with potential for short-term consequences.

³“Project Plan for the Chemical Safety Vulnerability Review,” dated March 14, 1994.

CSV-R-SRS-000-02: Knowledge about and characterization of chemical residuals at some facilities are not adequate.

Knowledge about and characterization of chemical residuals are not adequate at some facilities being transitioned to or undergoing D&D-type activities. A program to formalize requirements for transition of surplus facilities from program offices to EM-60, which includes a requirement for characterization of residuals, is under development but is not in place at SRS. Hazards analysis performed to assess the effect of chemical residuals on worker safety for the 412-D facility was not adequate. These conditions and circumstances represent a low- to medium-priority vulnerability with potential for short-term consequences.

CSV-R-SRS-000-03: In some cases, knowledge about chemicals and chemical inventory and the hazards communication program are not adequate.

Important information relevant to chemical safety is not always communicated to workers or management. Although WSRC has implemented a comprehensive hazards communications program, exceptions were found in the areas of labelling, availability of material safety data sheets, and chemical storage. The current WSRC lessons-learned program provided useful information to management and operations personnel but does not specifically highlight chemical safety information. There is no central, real-time system to track and provide information on extremely hazardous chemicals from procurement to final disposition. These conditions and circumstances represent a low- to medium-priority vulnerability with a potential for short-term consequences.

CSV-R-SRS-000-04: WSRC lacks a fully developed and implemented chemical safety program.

WSRC management systems for chemical safety are not fully implemented, and no overall program is in place for the entire site. This situation arises, in part, from chemical safety requirements being spread throughout multiple DOE Orders. WSRC recognizes the need to implement the programs necessary to support chemical safety. Initiatives are under way to meet site needs, such as the Chemical Commodities Management Center and the Surplus Facilities Transition Program. Until these management systems are developed and implemented uniformly across the site, the effective management and control of hazardous chemicals at SRS will remain diminished. These conditions and circumstances represent a low-priority vulnerability with a potential for short-term consequences.

CSV-R-SRS-000-05: Shifting departmental priorities are having an adverse affect on the site's overall chemical safety program.

Change of departmental missions is resulting in situations where workers are being shifted from production work in facilities they are familiar with to cleanup work in less familiar surroundings. Poor configuration management practices of the past have resulted in **less-than** adequate documentation of chemical residuals at some older facilities. Information related to chemicals, process and process histories, and facility modifications reside with personnel who have retired or who are contemplating retirement. Current budget projections reflect decreasing safety and industrial hygiene resource allocations after fiscal year 95, the timeframe in which D&D activities on site will be increasing. Lack of sufficient resources and

a DOE-imposed accelerated schedule for implementing the Surplus Facilities Transition Program may not permit proper planning and characterization of chemical hazards before D&D activities begin. These condition and circumstances represent a low-priority vulnerability with a potential for short-term consequences.

ATTACHMENT 1

TEAM COMPOSITION

<u>Area of Responsibility</u>	<u>Name/Organization</u>
Team Leader	Bradley A. Peterson Office of Performance Assessment U.S. Department of Energy
Management/Operations	Bernard R. Kokenge BRK Associates, Inc.
Management/Training	Robert W. Everson Office of Safety and Quality Assurance U.S. Department of Energy
Chemical Process Safety	Ernest W. Johnson Oak Ridge Associated Universities
Industrial Hygiene	Carol L. Vega MSE, Inc.
Environmental Protection	Raymond F. Machacek Arthur D. Little, Inc.
Maintenance	F. Richard Myal Compa Industries, Inc.
Emergency Management	Robert D. Mogle Battelle, Pacific Northwest Laboratory
Site Liaison	Donna A. Jackson Savannah River Operations Office U.S. Department of Energy
Coordinator	Stephanie G. West Femald Environmental Management Company of Ohio
Technical Editor	Larry D. Warren Evergreen Innovations, Inc.

Attachment 2

CHEMICAL SAFETY VULNERABILITY REVIEW VULNERABILITY FORM

DATE: April 25, 1994

Site/Facility:	Savannah River Site
Vulnerability Number:	CSV-R-SRS-000-01
Functional Area(s):	Operational Control and Management Systems, Emergency Management Program

1. Brief Description of Vulnerability.

Some facilities and work packages are not receiving adequate hazards analysis.

2. Summary of Vulnerability.

In some cases, the chemical safety and hazard analyses for work planning and emergency response planning are not complete or adequate. This problem is enhanced for decontamination and decommissioning (D&D)-type activities due to inexperience in conducting cleanup processes, lack of overall understanding of the associated problems, and lack of defined operating parameters. In addition, chemical safety has not been given sufficient priority in the past.

3. Basis.

- a. Requirements:
 - DOE 5480.23
 - DOE 5481.1 B
 - DOE 5500.3A
- b. Chemicals Involved:
 - Various solid sulfur-containing compounds
 - Benzene from tetraphenylborate solution
 - Sulfuric acid under pressure
 - Other hazardous chemicals and wastes throughout the site
- c. Relevant Self-Evaluation Data:
 - Definitions of environment, safety and health concerns
 - Programmatic action level
 - Vulnerability data inclusion
 - Prioritization recommendations
- d. Contributing Causes:
 - Potential hazardous chemical residues not identified
 - Governing procedures for some activities (i.e., D&D) have not been extensively used and may be inadequate for some evolutions
 - Insufficient definition of safe operating envelope for some activities
 - Lack of experience related to work proposed in some work packages
 - Heavy workloads for industrial hygiene personnel and their lack of involvement at pre-bid for subcontracts

Site/Facility:	Savannah River Site
Vulnerability Number:	CSVR-SRS-000-01
Functional Area(s):	Operational Control and Management Systems, Emergency Management Program

3. Basis. (Continued)

e. Potential Consequences:

- The lack of or inadequate hazards analysis can result in improper procedures and controls being applied to work involving chemical safety hazards. Accidents or releases involving hazardous chemicals are more likely to occur in this type of environment.
- Inadequate or inappropriate technical analyses of the consequences of chemical residues, which may be present on or in equipment or systems, can result in personnel exposures to those residues or environmental releases of their reaction products, especially when operations are changed or during D&D-type work.
- Without chemical safety analysis and hazards analysis information, the adequacy of emergency planning zones cannot be determined, emergency classifications recognition criteria and emergency action levels cannot be fully and accurately developed, and protective actions for workers and the public cannot be adequately determined. Without this information, the emergency plan and implementing procedures are inadequate or incomplete.
- These conditions and circumstances represent a medium-priority vulnerability with the potential for short-term consequences.

4. Supporting Observations.

- Industrial hygiene review of work packages for hazard analysis is not always thorough and complete and may result in workers not being knowledgeable of the hazards associated with the job being performed. This is caused, in part, by (1) pressure from work-package originators for quick turnaround of the work packages in the work review cycle and (2) not being requested to be involved at the pre-bid phase for subcontracts. Note the following examples:
 - Lead Job at 784-A(U). Initially, the contract specified a torch-cutting operation. Instead, the work involved torch cutting of carbon steel painted with a lead-based paint. This change in process required the subcontractor to provide medical surveillance and lead training for personnel before the work was started. Consequently, the project was delayed. Had this work been allowed to start, overexposure to lead was possible.
 - 773A and 735A Carpet Removal. Initially, the industrial hygiene representative was informed that the project was only to remove a carpet. During removal of that carpet, asbestos-containing tile was found under the carpet. This process required several personnel to work numerous overtime hours.
- DOE 5480.23 requires chemical safety analysis and hazards analysis information to be developed or updated for nuclear facilities.
 - Site personnel from the Federal Regulatory Compliance Group stated that some safety-related documentation at the Savannah River Site (SRS) has not been updated for almost 10 years. Old safety analysis reports (SARS) may not contain up-to-date chemical safety and hazards analysis information.

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM (Page 3)

DATE: April 25, 1994

Site/Facility: Savannah River Site

Vulnerability Number: CSV-R-SRS-000-01

Functional Area(s): Operational Control and Management Systems, Emergency Management Program

4. Supporting Observations. (Continued)

- A schedule for SAR update shows that update of some SARS may not be completed for several years.
 - Although the SARS for nuclear facilities are being updated (long term), the basis for interim operations (BIOS) should capture the chemical analysis information sooner.
- DOE 5481.1 B requires chemical safety analysis to be developed for nonnuclear facilities. Nonnuclear facility SARS have not been developed at SRS. Chemical safety analysis and hazards analysis are not complete for the nonnuclear facilities.
 - SRS is taking positive actions to determine which nonnuclear facilities will be required to have an SAR.
 - Implementation guidance has not been provided by DOE Headquarters.
- A thorough hazards analysis review for chemical safety concerns related to D&D-type activities is especially important due to the lack of experience in this area. Although most operating facilities have fairly well defined safe operating envelopes, the same cannot be said for D&D-type activities. Many procedures to be used during D&D are relatively new to site personnel. Chemical residuals may also introduce unknown variables that must be addressed. The problems that can occur if hazards analysis is not adequately performed are demonstrated in the incident that happened at the 412-D Heavy Water Extraction Facility. On November 11, 1993, a worker appeared to have inhaled toxic gases after a pipe that contained chemical residues was cut. Lack of an appropriate technical assessment and of an appropriate chemical characterization was a contributing cause in the incident.
- Neither of the site welding manuals, SRSESM 050507-1 O-R or CMP 11-10.01, identifies the need for technical assessment of any potential internal chemical contaminants that could be encountered during a cutting or welding of pipes or vessels. This requirement has not been incorporated into these manuals even though the incident at the 412-D Heavy Water Extraction Facility occurred 6 months ago, which indicates that chemical safety is not adequately covered in some procedures.
- In addition to their other duties, some members of the industrial hygiene staff review as many as 50 work packages per week. Pressure is exerted on the department by work-package originators to provide quick turnaround of work packages. As D&D-type activity increases, this problem will increase. In addition, industrial hygiene staff are not always requested to be involved during pre-bid activities for subcontracts. As a result, industrial hygiene review of internal work packages may not always provide for a complete and thorough job hazards analysis before work is started.

**CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM (Page 4)**

DATE: April 25, 1994

Site/Facility: Savannah River Site

Vulnerability Number: CSVR-SRS-000-01

Functional Area(s): Operational Control and Management Systems, Emergency Management Program

4. Supporting Observations. (Continued)

- Westinghouse Savannah River Company (WSRC) technical personnel believe that the use of premixed sodium tetraphenylborate solution at the in-tank precipitation facility, being delivered on an as-used basis, will preclude the possibility of excessive in-tank degradation of the active reagent and minimize the inventory (and hence chemical vulnerability) of this process chemical. The decision to proceed in this manner has not been finalized even though the facility is being prepared for startup. The 188,000-gallon tank was designed and constructed based on limited options related to existing vendor capability. The requirement for this large tank has now disappeared, and recent vendor problems with sodium tetraphenylborate storage and processing indicates that smaller onsite quantities of this solution are advisable.
- A restricted workday case was recorded when an employee received second-degree burns after being sprayed with 94 percent sulfuric acid from a broken (1-inch diameter) acid line. This line was not insulated, was unsurveyed for wall-thickness and deterioration, and was located such that the failure resulted in a 20- to 30-foot spray distance (which reached an employee walkway).
- It was reported by WSRC emergency management personnel that there was a lack of concise facility-specific chemical safety analysis and chemical hazards analysis for facilities at SRS, and this adversely affects the emergency preparedness program. Information from chemical safety analysis and hazard analysis is a basis for developing emergency preparedness plans and implementing procedures. These personnel also stated that hazardous chemical information has not been kept current in safety-related documents.

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM

DATE: April 25.1994

Site/Facility:	Savannah River Site
Vulnerability Number:	CSVN-SRS-000-02
Functional Area(s):	Operational Control and Management Systems, Facility Physical Condition
1. Brief Description of Vulnerability.	
Knowledge about and characterization of chemical residuals at some facilities are not adequate.	
2. Summary of Vulnerability.	
Knowledge about and characterization of chemical residuals at some facilities being transitioned to or undergoing decontamination and decommissioning (D&D)-type activities are inadequate, Poor configuration management in the past and loss of experienced personnel have contributed to this lack of knowledge regarding chemical residuals. A formal program to characterize residuals at surplus facilities being prepared for transition is under development but is not in place. In addition, hazards analysis related to D&D-type activities are inadequate in some cases.	
3. Basis.	
<p>a. Requirements:</p> <ul style="list-style-type: none"> • 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response" • WSRC-8Q, <i>Emp/oyee Safety Manual</i>, Procedure 36, Process System Access" <p>b. Chemicals Involved:</p> <ul style="list-style-type: none"> • Elemental sulfur • Carbon • Ferrous sulfate • Carbonyl sulfide • Carbon disulfide • Sulfur dioxide <p>c. Relevant Self-Evaluation Data:</p> <ul style="list-style-type: none"> • Identified problem in Final Report Type B Investigation of November 11, 1993. Construction Worker Inhalation of Toxic Gas, dated January 1994 • Memorandum, "Chemical Safety Vulnerability Question Sets for Selected Savannah River Site (SRS) Facilities," dated April 1, 1994 <p>d. Contributing Causes:</p> <ul style="list-style-type: none"> • Lack of resources (staffing; environment, safety, and health budgets) • Accelerated schedule for transitioning facilities to the Office of Facility Transition and Management (EM-6o) • Lack of knowledge regarding past activities that resulted in the residuals 	

Site/Facility:	Savannah River Site
Vulnerability Number:	CSVN-SRS-000-02
Functional Area(s):	Operational Control and Management Systems, Facility Physical Condition

3. Basis. (Continued)

e. **Potential Consequences:** Knowledge about chemicals or chemical residuals associated with a facility are of primary concern when converting that facility to a new mission or performing D&D-type activities. In these cases, unforeseen conditions are much more likely to occur from unknown or misunderstood mechanism related to those hazardous chemicals. This may lead to chemical releases and worker exposure to hazardous chemicals. These conditions and circumstances represent a low- to medium-priority vulnerability with the potential for short-term consequences.

4. Supporting Observations.

- The Westinghouse Savannah River Company (WSRC) has established a policy that defines the actions necessary to transition surplus facilities. The policy has not been implemented and detailed requirements are not in place for transfer of shutdown facilities to EM-60. Recent direction from Headquarters, DOE, accelerated the schedule for this program to within the next 6 months versus 18 months as originally scheduled. Resource constraints and an accelerated implementation schedule may not permit proper planning and characterization of chemical hazards before facilities are transitioned to EM-60.
- On November 11, 1993, a worker at the 412-D Heavy Water Extraction Facility appears to have inhaled toxic gases after a pipe that contained uncharacterized chemical residues was cut. Lack of an appropriate technical assessment was a contributing factor in the incident. On November 12, 1993, the Manager of the Savannah River Operations Office directed a Type B Investigation be conducted in accordance with DOE 5484.1. The Investigation Board recognized that the Savannah River Site (SRS) had insufficient controls in place to prevent the toxic gas inhalation.
- Welding and cutting procedures were not in place to guide activities in which potentially hazardous materials existed. The final report was issued January 25, 1994; however, recognition of the need for technical assessment of internal contaminants that could be encountered during welding or cutting of a pipe or vessel has not been incorporated in either of the site welding and cutting manuals, SRSESM 0407-10R or CMP 11-10-1.
- The Board also recognized the lack of experienced technical personnel to support the work planning process. Many workers have taken early retirement (about 2,500), resulting in loss of historical familiarity with facilities. Facility shutdown and preparation of facilities for transition to EM-60 have forced many workers to find new jobs on site, sometimes using new skills in new surroundings.

**CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM (Page 3)**

DATE: April 25, 1994

Site/Facility: Savannah River Site

Vulnerability Number: CSV-R-SRS-000-02

Functional Area(s): Operational Control and Management Systems, Facility Physical Condition

4. Supporting Observations. (Continued)

- During a walkthrough of the 412-D Heavy Water Extraction Facility by team members, chemical residue was observed in a section of pipe that had been cut by a welding torch. The residue appears to be very similar to the residue involved in the incident on November 11, 1993. Pipes continue to be removed using the original welding and cutting procedures. On April 25, 1994, a work package, dated March 1994, was reviewed by team members to determine what employee protective measures were taken. The package requires fans when prevailing wind conditions are not adequate to remove toxic fumes. At times, asbestos and acid gas respiratory protection is required. (The employee at the site was wearing respiratory protection.) The supervisor verified this procedure was required to ensure protection. Employees are trained concerning hazards to be expected during the job. Water is sprayed on the cut after completion to reduce the temperature and thus stop any exothermic reaction.
- In the self-evaluation submission, WSRC identified an additional oily substance in the base of the hot and cold towers with a pH of about 1. While sampling and analysis has been initiated, it has not been vigorously pursued. On reviewing sampling data at the 412-D Heavy Water Extraction Facility, an analytical report for another oily substance showed a pH of about 3.3. A toxicity characteristic leachate procedure was not completed for this substance nor was an attempt made to identify other residue that could be present in the towers.
- During a walkthrough of the 164-P Power House, which is an abandoned facility, chemical residue was observed at a cleanout door of the smoke stack. The residue was yellow-gray in color and about 4 feet in diameter. The area in which the residue was located was open to the elements and drained to the coal-runoff basin. WSRC personnel questioned regarding the chemical composition of the residue did not know the characterization. Subsequent to the walkthrough, WSRC used x-ray diffraction techniques to analyze the deposit, and it found iron aluminum sulfate as the major constituent. Analysis for organic compounds has not been conducted. The analysis for organic compounds would be necessary before this facility is transitioned to EM-60. Having an uncharacterized chemical residue is a concern for planning any D&D-type activity.

**CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM**

DATE: April 25, 1994

Site/Facility: Savannah River Site

Vulnerability Number: CSVR-SRS-000-03

Functional Area(s): Identification of Chemical Holdings, Operational Control and Management Systems, Human Resource Programs

1. Brief Description of Vulnerability.

In some areas, knowledge about chemicals and chemical inventory and the hazard communication programs are not adequate.

2. Summary of Vulnerability.

In some cases, important information relevant to chemical safety is not being communicated to workers and management. Situations exist where extremely hazardous chemicals are not tracked, hazards are not adequately communicated, and understanding of chemical safety is incomplete. Expertise is not always shared by divisions and facilities to provide the most up-to-date working knowledge of hazards associated with operations activities.

3. Basis.

a. Requirements:

- 29 CFR 1910.1200
- 29 CFR 1910.106
- 40 CFR 262
- DOE 5460.10
- DOE 5700.6C

b. Chemicals Involved: Various hazardous chemicals throughout the site.

c. Relevant Self-Evaluation Data:

- Final Report Type B Investigation of November 11, 1993, "Construction Worker Inhalation of Toxic Gas"
- DOE F 5464.X, "Individual Accident/Incident Report"

d. Contributing Causes: Inconsistency in implementation of chemical health and safety programs throughout the site.

e. Potential Consequences: Lack of knowledge about or understanding of chemical safety hazards can result in development of hazardous conditions or situations in which workers make mistakes. Accidents or releases involving hazardous chemicals are more likely to occur in this type of environment. These conditions and circumstances represent a low- to medium-priority vulnerability with a potential for short-term consequences.

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM (Page 2)

DATE: April 25, 1994

Site/Facility:	Savannah River Site
Vulnerability Number	CSVR-SRS-000-03
Functional Area(s):	Identification of Chemical Holdings, Operational Control and Management systems Human Resource Programs

4. Supporting Observations.

- There is no system in place at the Westinghouse Savannah River Company (WSRC) for managing all aspects of chemicals from procurement to ultimate use and final disposition as either waste or excess. Furthermore, there is no system for tracking extremely hazardous chemicals once they arrive on site. Although WSRC has recognized this issue and is establishing a Chemical Commodities Management Group, this organization is not expected to be fully functional until the end of 1994. Lack of a system to track extremely hazardous chemicals represents a vulnerability over the short term and until the new group is functional.
- The current WSRC lessons-learned program provides thorough information for WSRC management and operating personnel from both internal and external sources. The program does not specifically separate and highlight chemical safety topics for use by WSRC organizations. This hinders communication of important chemical safety information to workers. WSRC plans to modify the lessons-learned program within the next 6 months to identify chemical safety as a specific topic.
- The comprehensive Hazard Communication Program includes hazard evaluation, material safety data sheets (MSDSS), hazard warning labels, and information and training has been prepared and implemented at the Savannah River Site (SRS). Most elements of the program are in place. However, flaws were observed in this program.
 - Inadequate labeling of containers was observed in the 320-M Analytical Laboratory, Reagent Preparation Laboratory. Several chemicals did not have the National Fire Protection Association (NFPA) labels that are required by the Savannah River Site Hazard communication Program, and one bottle containing nitric acid was labeled with the chemical formula only. The NFPA labeling system does not consider the target organ in its warning of hazards associated with a chemical.
 - MSDSS are the major tools for identifying hazards associated with chemicals and the actions necessary to mitigate exposures. Many defines were not readily accessible at SRS. At the 734-A Cylinder Shed, MSDSS were stored in a trailer located more than one block from the storage area; in the Environmental laboratory, Room 129, MSDSS were kept in an administrative office isolated from normal laboratory activities; for the L Reactor Chemical Storage Building, Building 11 O-L, MSDSS were kept in the maintenance shop.

DATE: April 25, 1994

Site/Facility:	Savannah River Site
Vulnerability Number	CSV-R-SRS-000-03
Functional Area(s):	Identification of Chemical Holdings, Operational Control and Management systems, Human Resource Programs

4. Supporting Observations. (Continued)

When incompatible chemicals are stored together, spontaneous combustion is a concern. Incompatible chemicals were stored together in at least three areas visited. At L Reactor, oxygen cylinders were stored next to unsupported flammable gas cylinders; cylinders containing 10 percent methane and 90 percent argon were stored in an area labeled for storage of oxygen cylinders; cylinders containing 10 percent methane and 90 percent argon were stored in an area labeled for storage of empty oxygen cylinders. In the Research Laboratory supply room, 773-A Chemical Stores, gallon containers of nitric acid and hydrogenschloride acid were stored in the corrosive storage cabinet. A representative from the Industrial Hygiene Department took the compatibility chart and will use it as a training tool for chemical coordinators.

- Neither of the site welding manuals, SRSESM 05057-1 O-R and CMP 11-10.1, identifies the need for technical assessment of any potential internal contaminants that could be encountered during welder cutting or welding of pipes or vessels. This requirement has not been incorporated into those manuals even though an incident occurred 6 months ago at the Heavy Water Extraction Facility.
- Industrial hygiene review of work packages for hazard analysis is not always thorough and complete and may result in workers not being knowledgeable about the hazards associated with the job being performed. This is caused, in part, by (1) pressure from work-package originators for quick turnaround of the work packages in the work review cycle and (2) not being requested to be involved at the pre-bid phase for subcontractor. Note the following examples:
 - Lead Job at 764-A(U). Initially, the contract specified a torch cutting operation. Instead, the work involved torch cutting of carbon steel coated with a lead-based paint. This change in process required the subcontractor to provide medical surveillance and lead training for personnel before the work was started. Consequently, the project was delayed. Had this work been allowed to start, overexposure to lead was possible.
 - 773-A and 775-A Carpet Removal. Initially, the industrial hygiene representative was informed that the project was only to remove a carpet. During removal of that carpet, asbestos containing tile was found. This process required several personnel working many overtime hours.

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM

DATE: April 25, 1994

Site/Facility:	Savannah River Site
Vulnerability Number:	CSVN-SRS-000-04
Functional Area(s):	Operational Control and Management Systems, Human Resource Programs

1. Brief Description of Vulnerability.

The Westinghouse Savannah River Company (WSRC) lacks a fully developed and implemented chemical safety program.

2. Summary of Vulnerability.

WSRC management systems for chemical safety are not fully implemented, and no overall program is in place for the entire site. [n part, this situation arises from chemical safety requirements being spread throughout multiple Department of Energy (DOE) Orders. Chemical safety initiatives have been **started by several** different WSRC organizations and a Chemical Commodities Management Center concept **is** in the early stages of development. Until these management systems are developed and implemented uniformly across the site, the effective management and control of hazardous chemicals at the Savannah River Site (SRS) is diminished.

3. Basis.

a. Requirements:

- 29 CFR 1910.1450
- 29 CFR 1910.119
- 29 CFR 1910.120
- 29 CFR 1910.1200
- DOE 5000.3B
- DOE 5480.18A
- DOE 5480.19
- DOE 5480.20

b. Chemicals Involved: Various hazardous chemicals and wastes throughout the site.

c. Relevant Self-Evaluation Data:

- Type B incident at the 412-D Heavy Water Extraction facility
- Need for characterization of residuals at several of the listed facilities
- Cited management documents

d. Contributing Causes:

- No centralized chemical safety program
- Lack of implementation of management systems
- Chemical safety requirements are spread throughout multiple DOE Orders

e. Potential Consequences:

- Lack of a fully developed and implemented chemical safety program and corresponding management systems at SRS could result in:
 - A situation where chemicals can be "lost" in the system,
 - Failure to dispose of chemicals promptly,

**CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM (Page 2)**

DATE: April 25, 1994

Site/Facility: Savannah River Site

Vulnerability Number CSV-R-SRS-000-04

Functional Area(s): Operational Control and Management Systems, Human Resource Programs

3. Basis. (Continued)

- Improperly documented chemical residues in facilities and equipment,
- Failure to receive lessons-learned information on chemical safety issues, or
Failure to receive adequate training in chemical safety and identification of chemical hazards.
- Accidents or releases involving hazardous chemicals are more likely to occur when these conditions exist. These conditions and circumstances represent a low-priority vulnerability with the potential for short-term consequences.

4. Supporting Observations.

- WSRC has not implemented a consistent sitewide program to manage hazardous chemicals from procurement to ultimate use and/or disposition. Several organizations at SRS have established individual systems for handling chemicals, particularly those chemicals no longer needed. However, this process is being carried out on a fragmented basis. Other aspects of managing chemicals on site, such as evaluating nonhazardous substitutes, minimizing chemical inventories, tracking extremely hazardous chemicals, and ultimately disposing of chemicals no longer needed, are either not in place or are being accomplished in a fragmented manner. In addition, discussions with Savannah River Operations Office (SR) personnel, who are completing a management assessment related to chemicals, confirmed the need for WSRC to implement a sitewide system for managing chemicals that are no longer in use.
- WSRC management has recognized the need for developing programs to deal with most of the above issues. In response, WSRC is developing a Chemical Commodity Management Center that will provide centralized management of chemicals across SRS, but that center is not scheduled to be fully operational until the end of 1994.
- DOE has not promulgated the requirements for chemical safety in a single DOE Order. Instead, the requirements are spread throughout multiple Orders which has the effect, in part, of making different parts of the contractor organization responsible for their implementation. This Order, in turn, makes chemical safety program implementation more susceptible to fragmentation, particularly at large sites such as SRS.
- In the P Reactor Area, personnel have been assigned to identify excess chemicals in various locations throughout the area. Chemicals found are placed in the Reactor Division Chemical salvage Program. Some of the chemicals found were not clearly identified or labeled. This circumstance indicates a lack of chemical inventory control and has a negative effect on emergency planning for chemical releases from the area.
- WSRC plans to implement a Surplus Facilities Transition Program to formalize requirements for transitioning surplus facilities. When implemented, this program will require characterization of each facility with respect to chemical residues. This program is not currently in place.

**CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM (Page 3)**

DATE: April 24, 1994

Site/Facility:	Savannah River Site
Vulnerability Number:	CSVR-SRS-000-04
Functional Area(s):	Operational Control and Management Systems, Human Resource Programs

4. Supporting Observations. (Continued)

- A recent SR surveillance report (94-SD-ISB-0143) on the WSRC Process Safety Management (PSM) Program required by 29 CFR 1910.119 concluded that "WSRC has not provided sitewide direction or established a sitewide approach to PSM compliance and issues." The report noted that each WSRC line organization approached and interpreted the standard applicability requirements of PSM without clear sitewide involvement.
- WSRC does not plan to formally implement a PSM Program until fiscal year 95 because there are no hazardous chemicals on site in quantities that meet or exceed threshold quantity levels (TQLs). Nevertheless, this program will be required for compliance with the currently proposed Environmental Protection Agency rule for hazardous chemicals or when quantities of chemicals meet or exceed the TQLs.
- The present WSRC lessons-learned program provides thorough information for WSRC management and operating personnel from both internal and external sources. However, the program does not specifically separate and highlight chemical safety issues and information for use by the WSRC organizations.
- Completion of training is not consistently verified before personnel access is granted to work areas where hazardous chemicals are located. An exception to this is at the Tritium and HB-Line areas, where access is limited through issuance of proximity badges only to those personnel who have completed facility-specific orientation training. No other area of SRS has this requirement. Under these conditions, the potential exists that personnel could be exposed to hazards due to lack of training and would not know what to do in the event of an emergency.
- Training requirements for many contractor and subcontractor positions at SRS are not consistently defined or controlled. Training and qualification programs for operators and supervisors are being upgraded substantially in some facilities, such as the H and F Tank Farms and the Effluent Treatment Facility. In these facilities, a qualification and requalification program is being established, although it is not scheduled to be fully implemented before 1996. Formal training improvement plans do not exist for most remaining facilities at the site, and a goal for sitewide consistency has not been established.

**CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM**

DATE: April 25, 1994

Site/Facility:	Savannah River Site
Vulnerability Number:	CSVN-SRS-000-05
Functional Area(s):	Facility Physical Condition, Operational Controls and Management Systems, Human Resource Programs

1. Brief Description of Vulnerability.

Shifting departmental priorities are having an adverse affect on the site's overall chemical safety program.

2. Summary of Vulnerability.

Change of departmental missions is resulting in situations where workers are being shifted from production work in facilities they are familiar with to cleanup work in less familiar surroundings. Shrinking budgets are resulting in limited resources to address chemical safety. Continued loss of experienced personnel through early retirement, and possible reductions in environment, safety, and health (ES&H); quality assurance; and facility maintenance resources may occur in future years at the same time that D&D-type activities are increasing.

3. Basis.

a. Requirements:

- DOE 5480.10
- DOE 4330.4A

b. Chemicals Involved: Various hazardous chemicals and waste throughout the site.

c. Relevant Self-Evaluation Data: Not applicable.

d. contributing Causes

- Change of mission from production to decontamination and decommissioning (D&D)
- Workers being retrained to perform different types of work at different facilities
- Decrease in available staffing and budget for ES&H and maintenance activities
- Early retirement of highly experienced, long-tenured, personnel
- Time the facility has been idle before commencing D&D-type activities.

e. Potential Consequences:

- The factors listed above are combining to produce a workplace with:
 - Less experienced workers
 - A lower level of industrial hygiene support
 - A lesser ability to correct material problems
 - Loss of knowledge of chemical hazards associated with older facilities
 - More accidents or releases involving hazardous chemicals

These conditions and circumstances represent a low-priority vulnerability with a potential for short-term consequences.

**CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM (Page 2)**

DATE: April 25.1994

Site/Facility:	Savannah River Site
Vulnerability Number:	CSVR-SRS-000-05
Functional Area(s):	Facility Physical Condition, Operational Controls and Management Systems, Human Resource Programs

4. Supporting Observations.

- Many facilities are being shut down and prepared for transition to D&D. This situation has forced many workers to find new jobs on site, sometimes using new skills in new surroundings. In addition, many workers (about 2,500) have taken early retirement, which has resulted in a significant loss of experience. Although training programs are in place, the loss of experienced personnel with extensive experience working with hazardous chemicals could have adverse effects on the overall chemical safety program.
- WSRC does not have a formal program to address the loss of experienced personnel due to retirement and declining budgets. However, WSRC (1) regularly recalls retirees to review various areas when questions arise, (2) supports annual gathers of SRS retirees, and (3) makes use of logbooks and operating records retained at the site. WSRC plans to continue this approach as SRS moves to increased D&D-type activity in the future. However, this creates the potential for loss of corporate memory. To offset this loss, WSRC management plans to pursue conduct of operations and training for future D&D-type projects. Nevertheless, erosion of the experience base is expected to continue as SRS moves to increased D&D-type activities.
- Poor configuration management practices in the past have resulted in less than adequate documentation of chemical residuals at some older facilities. In many cases, knowledge related to problems that may be encountered during cleanup resides only in the memories of experienced workers. As older workers are lost through early retirement (or are replaced by employees not historically familiar with the facility), old problems may surface. This situation is exacerbated by the length of time between facility shutdown and the time the facility is transitioned to the Office of Facility Transition and Management (EM-60).
- The availability of industrial hygiene staff to support activities at the Savannah River Site (SRS) is limited. Industrial hygiene support has been noted in past assessments as an area that needs improvement. However, because of continuing constraints on budgets, the situation remains about the same. Despite budget declines, the workload for industrial hygienists has not changed and extensive overtime is required (the average industrial hygienist works 17 hours of overtime per week). This situation may result in people being less effective, with the possibility of important items being overlooked. The Westinghouse Savannah River Company (WSRC) industrial hygiene management is evaluating ways to make more effective use of these personnel, such as allocating them to more critical, higher priority work, and eliminating or changing the way existing lower priority tasks are performed.
- As part of an internal budget exercise, WSRC is studying the impact of funding decrements of as much as 30 percent in areas of ES&H, quality assurance, and maintenance. Such reductions, if implemented, would continue to diminish the overall industrial hygiene program effectiveness (e.g., Hazardous Communication, Health Hazard Assessment, Hazard Prevention and Control, Purchase Approval Program, Chemical Monitoring, Heat Stress Management, Hearing Conservation).

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM (Page 3)

DATE: April 25, 1994

Site/Facility: Savannah River Site

Vulnerability Number: CSVR-SRS-000-05

Functional Area(s): Facility Physical Condition, Operational Controls and Management Systems, Human Resource Programs

4. Supporting Observations, (Continued)

- The current 5-year WSRC budget plan indicates an essentially constant full-time equivalent (FTE) level for industrial hygiene and safety staff for fiscal years (FYs) 94 and 95. However, the plan indicates a decline from 120 FTEs in FY 95 to 114 FTEs in FY 96 and a further decline to 107 FTEs by FY 2000. This declining level of resources, crucial to supporting chemical safety, comes at a time when waste management and D&D-type activities are increasing at SRS. This apparent disparity, not having sufficient resources available to review the type of hazards associated with an increasing and diverse D&D work environment, represents a potential vulnerability.
- Insufficient resources and a DOE-imposed accelerated schedule for implementing the surplus facilities transition program could hamper proper planning and characterization of chemical hazards during the transition phase.

Attachment 3
SELECTED ACRONYMS

ES&H	Environment, Safety, and Health
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
SR	Savannah River Operations Office
SRS	Savannah River Site
WSRC	Westinghouse Savannah River Company